Author(s): Raike, Antti

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Searching Knowledge CinemaSense as a Case Study in Collaborative Production of a WWW Service in Two Universities

Antti Raike

University of Art and Design
Hämeentie 135 C, 00560 Helsinki, Finland
http://www.uiah.fi/~araike/
http://elokuvantaju.uiah.fi/

Abstract. In this paper I will present design research carried out between 1999–2004 at the University of Art and Design Helsinki in collaboration with the Classroom Teacher Training Programme for Finnish Sign Language Users of Jyväskylä University, Finland. The aim of the project was to produce an accessible web-based study product, as well as to clarify the sign language students' deepening of knowledge and conceptualization related to the subject of cinematic expression, as well as their collaboration during the web-based course. The aim of the design research was connected to the general aim of inclusion, for a shared university for all, which adapts flexibly to the needs of different and diverse students. The design research was positioned in the areas of film art and pedagogy. By merging participatory action research and WWW production a collaborative study concept dealing with cinematic expression entitled, *CinemaSense*, was developed and produced as part of the research work. It can be accessed at http://elokuvantaju.uiah.fi/. The usability and accessibility of the *CinemaSense* was observed during web-based courses in cinematic expression during 2001, with the help of a concept survey and network-based communication.

1 Design Research and ICT Tools for Accessible CSCL

Collins & al. [1] argue for the need to develop design research and science to investigate how different designs of ICT affect dependent variables e.g. in teaching and learning; just as in aeronautics, where researchers look at how different designs affect dependent variables. Physics, biology, and anthropology can be viewed as analytic sciences, where the effort is to understand how phenomena in the world can be explained. Aeronautics, AI, and acoustics can be viewed as design sciences, where the goal is to determine how designed artefacts behave under different conditions.

Design begins by asking, who is the artefact for and do they need it [2]? *Design for all* (DfA, universal or inclusive design) links to the concept of an *inclusive society*; it is a broad-spectrum solution and a part of modern, multi-cultural society,

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meant to help every citizen. DfA is an approach to the design of products, services and environments to be as usable and as accessible as possible by everyone regardless of age, ability, culture or situation. *Usability* describes how easily an artefact can be used by any type of user. *Accessibility* describes how easy it is for people to get, use, and understand artefacts. However, in HCI (Human-Computer Interaction) or in ICT (Information and Communication Technology) accessibility may refer to the usability of ICT by people with disabilities. Due to this it is rare to find a DfA product for learning that is used mostly by non-disabled people; products and services marketed as having benefited from a DfA process are often actually the devices customized specifically for use by people with disabilities. Hence, a term adaptive technology could be used more precisely when hardware or software is used to customize a computer for a disabled person [3].

Thus DfA is an inclusive and proactive approach seeking to accommodate diversity in the users and usage contexts of interactive products, applications and services, starting from the design phase. DfA becomes essential as life expectancy has risen and modern medicine has increased the survival rate of the population. The knowledge-intensive information society itself changes radically the way students study and interact with each other and with information [4]. DfA in higher education augment fully able students as well as students with disabilities to access content in their preferred way: e.g. it is rather easy for students with normal vision and with vision impairment or dyslexia to adjust text sizes and colours of an interface [5]. Furthermore, Namatame & al. [6] aimed to design web-based interactive educational materials for the hearing-impaired based on their interaction style. The results of an eye-tracking experiment demonstrate behavioural differences between hearing-impaired and hearing students when using web-based educational materials, which might suggest that the design of web-based materials is insufficient for the hearing-impaired. Another challenge of DfA is to make ICT tools for CSCL (Computer Supported Collaborative Learning) accessible to students with cognitive disabilities; including those with poor communication or reduced reading skills. Similarly there are several types of unobtrusive or disputable cognitive disabilities which are more difficult to diagnose than hearing or vision impairment or colour blindness: dyslexia or autism, motor or dexterity disability such as paralysis, cerebral palsy, and carpal tunnel syndrome. These all have impact on the design and use of ICT in higher education. But what is good Design for All practice in higher education? How do you design a service for all possible students?

2 Research and Methodological Approach

The research problem to solve was how to produce an accessible WWW service on cinematic expression, which supports both collaborative web-based learning as well as individual development of knowledge in the field of film [7–9]. The methodology was based on user-centric and participatory design methods to launch a collaborative design research [10–12]. At the commencement, a service concept for flexible collaborative web-based study of film was developed and the first version

of the *CinemaSense* portal was produced [13] (fig. 1). Secondly, the WWW service was tested and developed into an accessible and multi-cultural, art subject, web-based study format with the help of Deaf students [14–16]. Thirdly, observations and experiences from the design research were sought for theoretical consilience with the help of constructive and collaborative learning theory, interdisciplinary with the cognitive sciences and research of cultural evolution. [17]

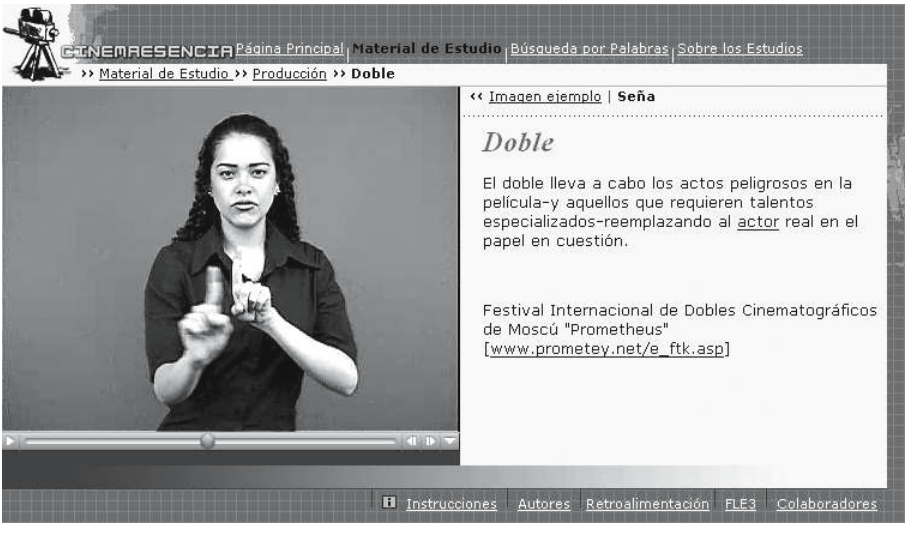

Fig. 1. Spanish version of the CinemaSense – CinemaEsencia – with Colombian Sign language, `http://elokuvantaju.uiah.fi/`

A grounded theory approach was used where a textual database or corpus (such as emails of the participants) was read and re-read to discover or label variables and their interrelationships [18]. The data of the research was made up of the concept maps [19], questionnaires, e-mail messages, diaries and documentary films of the research group participants as well as the concept maps and initial questions of the control group. Beside the corpus, all aspects of the inquiry learning process, i.e. setting up research problems, constructing ones own working theories, searching for new scientific information, was shared with fellow students by using a shared CSCL database during studies. The information objects, e.g. in the form of notes, were produced as a dialogue so that each note was commenting and linking to another. The metadata of each note like, the author's name, the category of inquiry defined by the author, and to which note it is referring to was created during the dialogue. Finally the data was complemented with the e-mail communication of the *CinemaSense* production group members as well as the MA thesis project, dealing with the *CinemaSense* production process. As a result, there was information in the large data corpus of the Deaf students' emails, learning environment (FLE) [20] discussion messages and concept maps drawn by each student during film study workshops.

Different self-organizing maps (SOM) were generated based on the metadata and the written information in the subject and body of the notes [21]. The SOM is a widely used artificial neural network model. Similarity clustering achieved by means of the SOM is suggested as an alternative or complementary method to conventional list-based approaches of organizing large data characterized by significant patterns of multiple criteria [22, 23]. Finding structures in vast multidimensional data sets like students e-mail messages is difficult and time-consuming. Kohonen's SOM can be used to aid the exploration; the structures in the data sets are illustrated on map displays where similar items lie close to each other [24]. The SOM learning process is unsupervised: no a priori classifications for the input examples are needed. The learning process is based on similarity comparisons in a continuous space. The result is a system that associates similar inputs close to each other in the two-dimensional grid called the map (fig. 2).

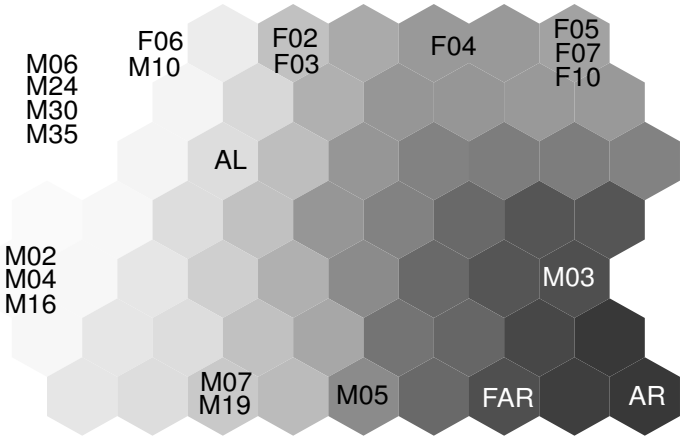

Fig. 2. A map of FLE learning environment and e-mail communication based on strategies of collaboration. F=FLE message, M=e-mail, 01–10=students of Jyväskylä; 16–35=students of Helsinki; AR=Tutor, AL=tutor of editing workshop. Note student 03 using e-mails (M03) near AR and clusters of students on the left of the map. The student 03 collaborates more in the learning environment (F03).

The input may be highly complex multidimensional numerical data [25]. The corpus was coded for the SOM analysis. The maps were then used to evaluate how students conceptualization evolved during the film studies in distance education, an important aspect of a collaborative and complicated project. Hence the SOM was a tool for getting an overview of the students learning and development of conceptual thinking, in this case concerning film art. From the researcher's viewpoint, it was difficult to find coherent patterns in such complicated data, because the significant information had to be collected from a vast corpus of

written texts. Hence presenting the students knowledge with maps reduced the cognitive load of the researcher.

3 Findings and Products

1. Theoretical investigation and description of the design research process as to how to produce a web service and basic level, net-based learning material for the study of cinematic expression.
2. The research group participants' concept maps became more conformed and their concepts became more professional whilst studying cinematic expression in the web-based course.
3. By the end of the web-based course the concept maps of the participants had developed from film viewer maps to filmmaker maps.
4. The research group traced professional production, designed and developed the subject of a documentary film, organized the production and produced three documentary films.
5. The accessible and multi-language *CinemaSense* v1.0 service and a web-study course concept for flexible art subject studies was produced. The research also increased understanding in interactivity of multi-lingual, web-based study. The results can be applied in the production of multi-modal web courses, interfaces and services that, for their own part, promote inclusion as well as multi-cultural and flexible university study.

4 Future Plans

Design and research solve the same problems of quality and innovation [9]. However, unlike research, design does not have to be new although it has to be good from the users perspective. A good design is not imposed on the students without first studying the intended users and figuring out what they need. Future design research projects should bring the concept Design for All (Universal design, inclusive design) under critical research by methods of practical design experiment. Thus it would be possible to discover a robust rationalization for the rather political concept of DfA which is mainly derived from the rhetoric of modern welfare state and information society.

The methodology of the design research should be developed as an interdisciplinary effort by reflecting data with the results of e.g. cognitive sciences and brain research. Further research should clarify the relation of so-called cultural universals, varying biological constraints and situated cognition for the collaborative design task. Researchers, designers, professionals, and students should codesign multimodal, multicultural, and multilingual interfaces for advanced studies in higher education. Design tasks should involve designers representing variable cultural backgrounds, and accessibility of the designed artefacts should be tested with users of diverse cultural and physical qualities. Hence design research would contribute to production of accessible and universal ICT tools for CSCL in higher education.

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